From Orlando Allen
Dec. 31. 1866

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2

REPORTS

ON

The Geology

OF THE

Tunungwant Coal Field,

M'KEAN COUNTY, PA.

By Dr. D. D. OWEN, of Indiana.

and

Prof. B. NEEDHAM, of Scranton, Pa.

BUFFALO:
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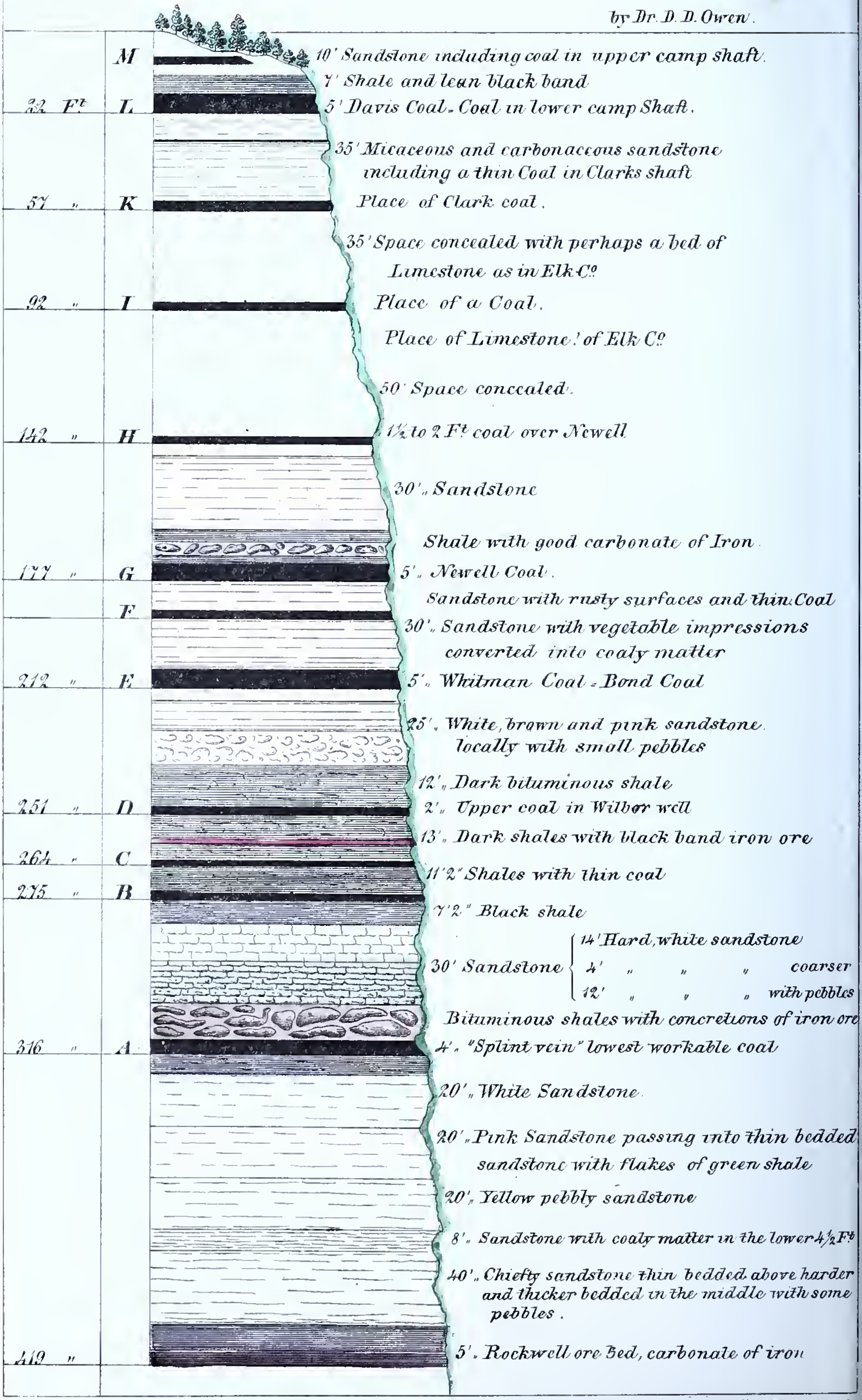
Vertical Section

by Dr. D. D. Owen.


M
10' Sandstone including coal in upper camp shaft.
7' Shale and lean black band
22 Ft L
5' Davis Coal = Coal in lower camp Shaft.
35' Micaceous and carbonaceous sandstone including a thin Coal in Clarks shaft
57 " K
Place of Clark coal.
35' Space concealed with perhaps a bed of Limestone as in Elk Co.
92 " I
Place of a Coal.
Place of Limestone! of Elk Co.
50' Space concealed.
142 " H
1½ to 2 Ft coal over Newell
30'" Sandstone
Shale with good carbonate of Iron.
177 " G
5'" Newell Coal.
F
Sandstone with rusty surfaces and thin Coal
30'" Sandstone with vegetable impressions converted into coaly matter
212 " E
5'" Whitman Coal = Bond Coal
25'" White, brown and pink sandstone locally with small pebbles
12'" Dark bituminous shale
251 " D
2'" Upper coal in Wilber well
13'" Dark shales with black band iron ore
264 " C
11'2" Shales with thin coal
275 " B
7'2" Black shale
30' Sandstone
14' Hard, white sandstone
4' " " " coarser
12' " " " with pebbles
Bituminous shales with concretions of iron ore
316 " A
4'" "Splint vein" lowest workable coal
20'" White Sandstone
20'" Pink Sandstone passing into thin bedded sandstone with flakes of green shale
20'" Yellow pebbly sandstone
8'" Sandstone with coaly matter in the lower 4½ Ft
40'" Chiefly sandstone thin bedded above harder and thicker bedded in the middle with some pebbles.
419 "
5'" Rockwell ore bed, carbonate of iron

Drawn by Gustavus Cox M. & C. Engineer.

Lith. by HATCH & Co 29 William St. N.Y.

Orlando Allen

GEOLOGICAL REPORT

ON

The Coal and Iron Lands

OF

D. KINGSBURY AND OTHERS,

McKEAN COUNTY, PENNSYLVANIA.

To Daniel Kingsbury.

Sir:

The lands which form the subject of this Report, of which I have made a survey at your request, are situated in McKean County, Pa., on the waters of the Tunungwant, Tunaette, and Kinzua, tributaries of the Alleghany River, and lie partly in Bradford, and partly in the adjacent Townships of Corydon, Lafayette and Hamilton, and comprise in all about 42,000 acres of land, the northern limits of which extend within about a mile of the New York State line.

A large portion of these lands occupy an extensive plateau, whence arise the branches giving origin to the heads of the above-named streams; the waters of the Tunungwant and Tunaette flowing to the north, while those of the Kinzua flow to the south.

The elevation of this table land is from 650 to 700 feet above the valley of the Tunungwant, near the state line between Pennsylvania and New York. The valley of the Tunungwant at this place—the base line of the railroad surveys of McKean County—is 844 feet above Lake Erie, and 1422 feet above tidewater; hence the average elevation of these table lands is about 1500 feet above Lake Erie, and 2100 feet above tidewater.

The base of the hills of McKean County, for about 150 feet, are composed of green, gray, and olive shales, and sandstones belonging to the age of the Ithaca and Chemung groups of the New York survey ; on these repose from 250 to 300 feet of red marls and red argillaceous sandstones, belonging to the old red formations, while about 250 to 450 feet* of the most elevated portion of the country consists of the coal measures, including mill-stone grit and conglomerate.

The sub-carboniferous limestone appears to be represented, in this part of Pennsylvania, only by a few feet of fossiliferous, dark gray limestone, underlying the sandstones and conglomerate at the base of the coal measures.

The main bed of coal of Bradford and Corydon Townships, which lies from 50 to 100 feet below the general level of the table lands, has, until recently, been overlooked, in consequence, probably, of its underlying a conglomerate or pebbly sandstone. A misapprehension in regard to the existence of workable coal under rocks of this description has, no doubt, contributed to this oversight. Though it may be true, as a general fact, that workable coals have seldom been discovered below the *main mass* of conglomerate or pebbly sandstone, at the base of the coal measures of the United States, yet I am able to cite, in my experience, several instances where good, workable coal occurs under the upper members of the conglomerate : for instance, the main coal, from 4 to 5 feet in thickness, worked on the Cumberland River above its shoals, in Pulaski County, Kentucky, which supplies Nashville, lies 40 feet below a pebbly sandstone or conglomerate, and only 150 feet above the top of the sub-carboniferous limestones ; and a coal, 2½ to 4 feet thick, has been worked in Crittenden County, under 60 feet of coarse grit stones, which is locally pebbly, and evidently the equivalent of the upper conglomerate of trade water ; while in Greenup County, coarse quartsoze sandstone, containing small pebbles, can be traced 400 feet up in the true coal measures. The fact is, that conglomerates and pebbly sandstones have been formed wherever there have been sufficient currents or commotion in the waters of deposition to sweep in coarse materials. The *principal* movements during the carboniferous era which established such currents, took place about the commencement of this formation; hence the *great mass* of the conglomerate lies at the base of our coal measures; but locally they have been produced (to a much more limited extent, however,) for some time subsequent to the introduction of the causes which produced regular beds of coal of sufficient thickness to be of commercial value; and this has been the case in McKean County, Pa.: consequently we find a bed of good workable coal lying 30 to 50 feet under one of the upper masses of conglomerate or pebbly sandstones which underlies the table lands of Bradford, Lafayette, and Corydon Townships.

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* By reason of the southern dip, the coal measures are from 400 to 500 feet deep in the southern warrants.

The general dip of the coal measures is a little west of south, towards the valley of the Kinzua, which brings in, in the direction of Lafayette Township, 300 feet of additional strata, including at least three other workable beds of coal, in the south and south-western warrants on the tracts of land on which I am reporting.

The vertical geological section which accompanies this Report, represents the order of superposition of the coal measures of McKean County. It includes, as will be seen, eleven to twelve different beds of coal in a space of 330 feet of these lower coal measures, lettered from A to M, inclusive. At least four of these are good workable beds, lettered A, E, G, and L.

The lowest of these, A, known usually under the name of the "Splint Vein," averages four feet in thickness, covered generally by eleven feet of bituminous shales, containing, locally, considerable masses or seggregations of carbonate of iron, upon which reposes 30 to 60 feet of sandstone, the lower 12 to 20 feet of which contains pebbles. Superimposed on this sandstone, there are from 40 to 50 feet of dark shales,

225724

known as the "Wilber Shales," containing several thin beds of coal, interstratified with which are some valuable bituminous carbonates of iron or "*black band*" iron ore; then succeeds in the ascending order, 25 to 30 feet of white, brown, and pink sandstone, also containing occasionally small pebbles: on this rests coal E, known as the "Whitman Coal," composed of two varieties of coal, one a hard, bright bituminous coal, with alternate, thin, dull layers; the other a compact cannel coal, measuring in all upwards of five feet in thickness. The roof of this coal is a dark sandstone, charged with disseminated carbonaceous and coaly particles, passing upwards into thin bedded sandstones, with rusty surfaces, embracing a thin coal, F, in all about 30 feet.

This rock forms the floor of the next coal, G, with the intervention of very little fire-clay. This is the "Newell Coal." In the space which succeeds in the ascending order of 150 feet, there are two, if not three, beds of coals; but it is not known at present whether any of these are of workable thickness, since no satisfactory openings have been made on them: one supposed to be from 1½ to 2 feet thick (H of the section) has been reached on Warrant 2264, a short distance to the east and above the Newell opening, and is very likely the same bed which has been partially opened on Warrant 2256, forty-eight feet above Tidd's house, and 7000 feet in a horizontal distance to the west, and reported to be from 18 inches to 2 feet thick.

Another coal (I of the section) is reported at the bottom of a shaft sunk by Mr. Clarke, on Warrant 3255. This is probably the same bed which has been reached in several wells on the same Warrant, in and about Lafayette corners.

The coal with ore over it reported in a shaft on Warrant 2257, a short distance to the east of Tidd's house, may possibly be a distinct bed of coal from any of these heretofore described; but it is more probable that it is identical either with the "Newell" or "Whitman" vein. The coal L, of the section, known as the "Davis Coal," which lies 30 to 40 feet above K, will yield five feet of workable coal, and, therefore, enters into the calculation of workable coal on all Warrants southwest of its outcrop on Warrant 2255.

In the sequel of this report, the four workable coals of this section will be referred to by the letters appended in the section, viz., A, E, G, L.

The following chemical analyses of these coals exhibit their composition, qualities and practical application:

Analysis of Coal A, of the Section.

Specific Gravity, 1.294.

Moisture,	2		
Volatile combustible matter,	32	Total volatile matter,	34
Fixed carbon in coke,	59		
Ashes, (gray,)	7	Coke,	66
	100		100

The ultimate analysis which exhibits the total amount of carbon both in the coke and volatile combustible ingredients, as well as the proportion of other elementary substances of the volatile *combustible* matter, gives a still clearer insight into the qualities and properties of this coal.

1st. *Calculated from* 100 *parts of the raw coal with its natural moisture and ashes:*

Carbon, total in coke and volatile matter.	69.272
Hydrogen,	4.240
Oxygen, with a little Nitrogen,	15.488
Sulphur,	1.000
Ashes,	7.400
Moisture, (hygrometric),	2.600
	100.000

2d. *Calculated from* 100 *parts, the coal dried at* 212° *Fahrenheit:*

Carbon,	71.110
Hydrogen,	4.353
Oxygen and Nitrogen,	16.111
Sulphur,	1.026
Ashes,	7.400
	100.000

3d. *Calculated from* 100 *parts of dry combustible matter:*

Carbon,	76.199
Hydrogen,	4.664
Oxygen and Nitrogen,	18.037
Sulphur,	1.100
	100.000

The proximate analysis of this coal is very nearly the same as that of the coal of Chesterfield County, Virginia. Unfortunately we have no ultimate analysis of that coal to enable us to draw a more satisfactory comparison. It is also in this respect very nearly allied in composition to the lower hard coal, Batterly Park Colliery, used in the blast furnace at the Batterly Iron Works, in Derbyshire, England, and its ultimate elements are very nearly the same as the Macken Rock vein of the Welsh coal fields—and the Blanzy coal of France—and the Todd and Crittenden coal forks of the Kentucky River, which occupies the same geological horizon as Coal A.

It is a coal well adapted for the manufacture of iron, since it will not be driven so fast before the blast as the softer, fat bituminous coal, and thus be capable of "carrying a good burthen." It contains too much oxygen to be a very rich gas coal; but containing within one per cent. as much fixed carbon in the coke as the Pittsburg, it will be a coal well suited for the grate, since it will make a hot, durable fire without throwing off sooty flakes. It contains five to eight per cent. more fixed carbon than the average of the Glasgow coals.

Its evaporative power, for equal weights of coal, is about 800, the Maryland semi-bituminous being 1000; its evaporative power for equal bulks about 700. It will take a very high rank for efficiency of action in evaporating water; but for facility of ignition it will rank below the average. The sum of its relative value, taking all these properties into consideration, will be about 3000, Maryland semi-bituminous, of George Creek Valley, being 3625, and Scotch coal 2750.

One pound of coal will produce about nine pounds of steam at 212°, and 9½ to 10 lbs. of steam for every 1 lb. of *combustible* matter in the coal. Sixty pounds of this coal will produce about fourteen links of chain cable of 1⅜ inches diameter. It is free from disseminated pyritiferous impurities.

Two Proximate Analyses of the Bituminous Coal E, gave

Specific Gravity, 1.487.

Moisture,	2.		
Volatile combustible matter,	38.2	Total volatile matter,	40.2
Fixed carbon in coke,	54.8		
Ashes, white,	5.	Coke,	59.8
	100.		100.

Moisture,	2.		
Volatile combustible matter,	31.3	Total volatile matter,	33.3
Fixed carbon in coke,	64.2		
Ashes,	2.5	Coke,	66.7
	100.		100.

The bituminous part of this coal is a hard bright coal, resembling the coals of North Staffordshire, used for iron-making, and coking for locomotives.

The specimens of the cannel part of this seam have not come to hand, and I can, therefore, give no analysis of it; but from an analysis made by Prof. Chilton, of New York city, I can recommend it as a good coal for the several uses to which cannel coal is applied, especially for gas making, as proved by the results of a trial made by the Manhattan Gas Company, of New York city, with this coal.

One ton of 2000 lbs. yielded 9691 feet of gas, and forty-four bushels of coke weighing 1523 lbs.

This coal seems to be variable in the proportion and quality of the two varieties, and has sometimes two clay or slatey partings.

At one locality it was made up as follows:

	Ft. In.
Bituminous coal,	.9
Clay parting,	.6
Cannel coal,	1.5
Black shale or slaty cannel,	.3
Bright bituminous coal,	1.8
Clay parting,	.2
Bright bituminous coal,	.9
	5.6

At another location it was made up of the following members:

	Ft. In.
Bituminous coal,	1.4
Cannel coal,	1.9
Clay parting,	.2
Bright bituminous coal,	3.0
	6.3

In the Whitman Well it is reported:

	Ft. In.
Bituminous coal,	2.0
Cannel coal,	2.0
Clay parting,	.3
Bituminous coal,	1.4
	5.7

The Analysis of G Coal gave

Specific Gravity, 1.318.

Moisture,	1.5		
Volatile combustible matter,	37.5	Total volatile matter,	39.
Fixed carbon in coke,	56.		
Ashes, light gray,	5.	Coke, inflated,	61.
	100.		100.

The ultimate Analysis of this Coal (G) gave:

Moisture,	2.8
Carbon in coke and volatile matter,	72.436
Hydrogen,	5.555
Oxygen and Nitrogen,	7.709
Sulphur,	.500
Ashes,	11.000
	100.

Calculated from 100 *parts of combustible matter we have:*

Carbon,	83.740
Hydrogen,	6.410
Oxygen and Nitrogen,	9.272
Sulphur,	0.578
	100.

This ultimate analysis shows this to be a fat, partially coking coal, with a long flame, rich in hydro-carbons, and, therefore, well adapted for gas making. The proximate analysis is very nearly the same as that of the main coal extensively worked in the Derbyshire coal field, except that it has rather more volatile matter.

The Proximate Analysis of Coal L gave

Specific Gravity, 1.321.

Moisture,	1.5		
Volatile combustible matter,	39.5	Total volatile matter,	41.
Fixed carbon in coke,	55.		
Ashes, dark gray,	4.	Coke, inflated,	59.
	100.		100.

The ultimate analysis gave:

Moisture,	2.100
Carbon in coke and volatile matter,	75.545
Hydrogen,	7.222
Oxygen and Nitrogen,	5.133
Sulphur, a mere trace.	
Ashes, red,	10.
	100.

Calculated from 100 *parts of dry combustible matter this gives:*

Carbon,	85.846
Hydrogen,	8.206
Oxygen and Nitrogen,	5.948
	100.

This coal contains more hydrogen than its appearance would indicate. I attribute this peculiarity to the fact that it lies very close to the surface where the specimens were procured, in which position it has necessarily been long exposed to moisture, and, though carefully dried at 212° before being placed in the combustion tube for analysis, it has evidently retained considerable moisture. In its proximate analysis it resembles the coal of the Batterly Park, Derbyshire coal fields.

COAL A, has an average thickness of four feet, and an area in the various Warrants of the McKean County lands, situated on the plateau west of the Tunungwant, as follows:

On Warrants.	Acres.	Tons.	On Warrants	Acres.	Tons.
4910	800	3,200,000	4909	1100	4,400,000
3414	700	2,800,000	3416	747	2,988,000
3437	608	2,432,000	3904	558	2,232,000
2276	1100	4,400,000	2277	1041	4,164,000
2275	760	3,040,000	2278	55	220,000
4908	1100	4,400,000	4907	1100	4,400,000
3420	1070	4,280,000	3431	782	3,168,000
3430	249	996,000	3429	125	500,000
2286	900	3,600,000	2287	1000	4,000,000
2285	150	600,000	4876	550	2,200,000
3426	675	2,700,000	3422	400	1,600,000
3425	800	3,200,000	3428	500	2,000,000
3350	120	480,000	3309	81	324,000
3908	135	540,000	3907	430	1,720,000
3413	3300	13,200,000	2256	1383	5,532,000
3412			2255		
3436			2254		
3435			2257		
			2264		
			3432		
			2253		
		49,868,000			39,448,000
			Brought over,		49,868,000
Total area of Coal A west of the Tunungwant, . .					89,316,000

COAL E, with a thickness of 5 feet, has an area as follows:

On Warrants.	Acres.	Tons.	On Warrants.	Acres.	Tons.
3413	1000	5,000,000	2256	1045	5,225,000
3412			2255		
3436			2254		
3435			2257		
			2264		
			3432		
			2253		
		5,000,000			5,225,000
			Brought over,		5,000,000
Total area of Coal E, west of the Tunungwant, . .					10,225,000

Coal G, with a thickness of 5 feet, has an area

On Warrants.	Acres.	Tons.	On Warrants.	Acres.	Tons.
2256	1030	5,150,000	3413	800	4,000,000
2255			3436		
2254			3412		
2257			3435		
3264					
3432					
2253					
		5,150,000			4,000,000
				Brought over,	5,150,000
Total area of G Coal west of the Tunungwant, . .					9,150,000

Coal L, with a thickness of 5 feet, has an area as follows :

On Warrants.	Acres.	Tons.
2256	175	875,000
2255		
2257		
2264		
3432		

On the *east* side of the Tunungwant, Coals A and E have the following area :

Coal A.			Coal E.		
On Warrants.	Acres.	Tons.	On Warrants.	Acres.	Tons.
3329	610	2,440,000	2284	630	3,150,000
2284	1267	5,068,000	2279	505	2,525,000
2283	1014	4,056,000	2274	450	2,250,000
2279	1190	4,760,000	2283	760	3,800,000
2274	900	3,600,000			
		19,924,000			11,725,000

Taking the total area of workable coals there will be 27,300 acres, which will yield, at a low estimate, 141,215,000 tons of coal from all the various beds united.

TABLE OF ANALYSIS OF COAL FROM McKEAN COUNTY, PENNSYLVANIA, AND OTHER LOCALITIES.

	McKEAN COUNTY. KINGSBURY TRACT.				PENNSYLV'A.	KENTUCKY.			OHIO.	VIRGINIA.	GREAT BRITAIN.				
						SOUTH'N MARGIN.	EASTERN MARGIN.								
	Splint.	Cannel.	Newell.	Davis.	Pittsburg.	Hon. Jno. Bell's Mines.	Brecken-ridge.	Hawes-ville.	Pomeroy.	Clover Hill.	Worsboro' Furnace Coal. Splint.	Morley Park Furnace Coal.	Clyde Iron Works.	Newc'stle.	Bowling.
Thickness of Seam,	4 to 5 ft.		5 feet.	5¼ feet.	4 feet.	3 to 4 ft.	2⅛ feet.	3½ to 4 ft			4½ feet.				22 inch's
Specific Gravity,	1.294		1.318	1.321		1.274		1.397		1.285				1.257	
Total volatile matter,	34.		39.	41.	36.46	39.40		47.		32.94	38.18	37.86		37.60	32.55
Coke,	66.		61.	59.	63.54	60.60		53.		67.06	61.82	62.14		62.40	67.45
	100.		100.	100.	100.	100.		100.		100.	100.	100.		100.	100.
Moisture,	2.	.62	1.5	1.5	1.11	3.	.77	8.	3.49	.73				1.77	
Volatile & bitum. matter,	32.	41.77	37.5	39.5	35.35	36.40	63.52	39.	35.80	32.21	38.18	37.86	36.80	35.83	32.55
Fixed Carbon in Coke,	59.	46.45	56.	55.	60.14	57.60	27.16	46.	47.72	56.83	60.32	55.89	59.	57.	65.45
Ashes,	7.	11.16	5.	4.	3.40	3.	8.47	7.	12.99	10.23	1.50	6.25	4.20	5.40	2.
	100.	100.	100.	100.	100.	100.	99.92	100.	100.	100.	100.	100.	100.	100.00	100.00
Color of Ashes,	Gray.		Light Gray.	Dark Gray.	Gray.	Pale Flesh Color.			White.		White.	Gray White.			Drab.
	Well adapted for the manufacture of iron, ranks high for efficiency in evaporating water, a good grate coal, free from pyritiferous impurities.	Adapted to the manufacture of oils and gas.	Fat, partially coking coal with long flame, rich in hydro-carbon, well adapted for gas.			Highly esteemed for the use of steamboats, and for domestic purposes.	Fossil lepidodendron in body of the coal.		Slatey, freeburning, leaves no clinkers.		Used for iron smelting, splint coal with bright lines of bituminous coal alternatives, surface covered with bright cubes of pyrites.	A cannel coal; fracture partly in lines, and partly yolky, in places couchoidal and oolitic.		In very general use throughout England.	Iron made with this coal, very superior, and celebrated for car axles and locomotive tire.

Land Office D. Kingsbury.

Analyses

OF VARIETY OF ORE FROM ROCKWELL CUT.

1*st*, *Gray Fossiliferous Carbonate of Iron:*

Specific Gravity, 3,201.

Water, hygrometric,	0.80	
Protoxide of Iron,	20.09	=24,01 Iron.
Peroxide of Iron,	12.04	
Lime,	4.5	
Magnesia,	1.4	
Alumina,	4.	
Manganese, a trace.		
Carbonic acid,	18.	
Phosphoric acid,	.50	
Sulphur, a mere trace.		
Insoluble silicates,	38.50	
Loss and alkalies not determined,	.17	
	100.00	

2*d*, *Variety of Ore from Rockwell Cut; even textured, dove colored, fine grained Carbonate.*

Insoluble silicates,	25.	
Protoxide of Iron,	36.	=35. Iron.
Peroxide of Iron,	9.99	
Carbonic acid,	24.66	
Lime,	1.5	
Magnesia,	1.26	
Alumina,	1.	
Phosphoric acid,	.3	
Sulphur,	.06	
Loss and alkalies not determined,	.23	
	100.	

3*d*, *Variety: medium quality of gray Carbonate, with a few disseminated gravel stones.*

Insoluble silicates,	38.5	
Protoxide of Iron,	23.236	=27.35 Iron.
Peroxide of Iron,	12.244	
Carbonic acid,	17.2	
Lime,	2.	
Magnesia,	1.4	
Alumina,	3 5	
Phosphoric acid, a trace.		
Loss and alkalies not determined,	1.920	
	100.	

4*th*, *Variety: most earthy part of the gray Carbonate, with minute scales of mica disseminated.*

Insoluble earthy matter,	48.5	
Protoxide of Iron,	22.61	=23.1 Iron.
Peroxide of Iron,	7.86	
Carbonic acid,	16.50	
Lime,	1.50	
Magnesia,	1.40	
Alumina,	1.50	
Loss, alkalies, &c., not determined,	.13	
	100.	

5*th*, *Variety: part of the bed converted mostly into hydrated brown Oxide or Limonite.*

Insoluble earthy matter,	17.	
Protoxide of Iron,	8.05	=48.65 Iron.
Peroxide of Iron,	60.455	
Carbonic acid,	5.7	
Lime,	.5	
Magnesia,	.36	
Alumina,	4.	
Moisture,	3.5	
Loss, alkalies, &c., not determined,	.435	
	100.	

Taking the average of these five varieties we have 31.62 per cent. as the yield in metallic iron of the bed of the Rockwell cut in the aggregate where it has been reached on Warrant 3904 facing the declivity of Two Mile Run, on the head waters of the Tunaette. The same bed has been reached by a drift on Warrant 3329 on the waters of Minard Run, and is reported also more than twelve miles to the south-east of these tracts in Keating Township, where it is of corresponding thickness; hence we are justified in assuming it continuous. Inasmuch as it underlies the A Coal 110 feet, it may fairly be considered as having an area of at least 20,000 acres on the tracts of land in question. Allowing it to be only three feet thick, of solid ore, which is certainly a low estimate, since I believe there will be found in practice 3½ to 4 feet of workable ore, and since it has a specific gravity of over three, then we have in round numbers, 4000 tons of ore on every acre, or 80,000,000 tons on the whole track west of the Tunungwant capable of yielding upwards of 26,000,000 tons of cast iron; and probably more than one-third of this amount on the warrants on the east side of the Tunungwant, since it, no doubt, has an area of 6,500 acres on that tract of land.

The black band ore interlocated in the shaly space known as the Wilber shales of McKean County, associated with coals C and D, that lie between the sandstone overlying the A Coal and the sandstone that underlies the E Coal, yielded by chemical analysis the following results:

Specific Gravity, 3.069.

Moisture,	.8	
Protoxide of Iron,	56.25	=43.75 Iron.
Carbonic acid,	29.95	
Lime,	1.00	
Magnesia,	.72	
Alumina,	2.00	
Insoluble silicates,	6.50	
Sulphur,	.025	
Bituminous matter, loss, &c.,	2.755	
	100.	

This rich black band ore I estimated to be one foot in thickness, as nearly as I could judge from a view obtained in the shaft on Lewis' Run, which was partly filled with water at the time I was there. This shaft was afterwards cleared out

225724

and inspected by Mr. B. Needham, who reported it to be 18 inches thick.

This rich black band is overlaid by black band shales, eight inches of which yields 14 per cent. of iron, and 2 feet 11 inches, 5.6 per cent.; the succession being as here shown :

		Ft. In.
1.	Earth,	6.
2.	Ferruginous shales,	8.
3.	Black band, yielding 5.6 per cent.,	2.11
4.	Light olive shales,	.2
5.	Black band shale, yielding 14 per cent.,	.7
	Light olive shale,	.1
6.	Rich black band shale, yielding 43.75 per cent. iron, 1 ft. to	1.6

The Analysis of No. 5 *of this Section gave*

Specific Gravity, 2.61.

Insoluble silicates,	53.	
Protoxide of Iron,	18.=14. of Iron.	
Lime,	1.	
Magnesia,	1.45	
Alumina,	5.5	
Carbonic acid, bitumen, loss, &c.,	21.05	
	100.	

The Analysis of No. 3 *gave*

Specific Gravity, 2.502.

Insoluble silicates,	71.
Protoxide of Iron,	7.2=5.6 Iron.
Lime,	0.3
Magnesia,	0.907
Alumina,	7.
Carbonic acid, bitumen, loss, &c.,	13.593
	100.

Though these two last black band shales are not sufficiently rich in iron to be worked by themselves, they would answer as an addition to the furnace in connection with other ores; especially to rich silicious hydrated oxides or limonite ores, which require an admixture of argillaceous shales to form a normal slag and protect the reduced iron from the oxidizing influence of the blast. They would thus not only subserve this purpose, but increase the product of the furnace by the amount of iron they respectively contain.

The area over which this black band ore extends, may be taken at two-thirds the area of the A Coal—say 16,000 acres; this would give 10,000,000 tons of metal from the entire tract.

There are other spaces in these coal measures which may be expected to yield more or less iron ore. The shaly space over the G Coal affords specimens of an excellent variety of fine-textured carbonate of the protoxide of iron, the composition of which is shown by the subjoined chemical analysis :

Insoluble silicates,	11.5	
Protoxide of Iron,	54.	=42.01 Iron.
Carbonic acid,	27.2	
Lime,	2.0	
Magnesia,	1.8	
Alumina,	3.5	
	100.	

This ore will, therefore, yield forty-two per cent. of metallic iron. It is reported, at different localities where it has been reached by borings, to be from one to two feet thick. Since I have not been able personally to get a satisfactory view of the thickness of this bed of ore, I am unable at present to report definitely in regard to its actual dimensions and extent, but my impression is, from all the data gathered, that it may prove to be a valuable bed of ore over the southern part of the tract.

A drill-hole was put down under the five feet ore of the Rockwell Cut, and another ore bed reported below.

More or less ore may be expected in the eleven feet of shales forming the roof of Coal A, which yielded 21.72 per cent. of iron in the specimen analysed as follows :

Moisture,	.6
Insoluble silicates,	56.
Protoxide of Iron,	25.2=21.72 of Iron.
Carbonic acid,	10.
Lime,	1.5
Magnesia,	1.64
Alumina,	4.5
Loss, alkalies, &c.,	.56
	100.

The black band shales over the L Coal are too lean to be worked by themselves, as they only contain 6.3 per cent. iron. The analysis gave

Insoluble earthy matter,	77.
Protoxide of Iron,	8.1=6.3 Iron.
Lime, a trace.	
Magnesia,	.72
Alumina,	7.
Carbonic acid, sulphur, loss, &c.,	7.18
	100.

Coal A and E, and probably L, are underlaid by fire-clays adapted for the manufacture of fire brick, and other purposes.

COMPARATIVE ANALYTICAL TABLE OF IRON ORES.

	IRON ORES FROM THE KINGSBURY TRACT, McKEAN COUNTY, PENNSYLVANIA.								KENTUCKY.	GREAT BRITAIN.								CLAY IRON STONES, IN NODULES AND BEDS, IN THE COAL MEASURES OF FRANCE.							
	Black Band, 1 foot 6 inches.	Black Band Shales, overlying Black Band Ore.	Fine Carbonate, overlying Newell Coal.	Nodular Shales, found in the roof of Splint Coal.	Rockwell Cut, 1st Variety.	Rockwell Cut, 2d Variety.	Rockwell Cut, 3d Variety.	Rockwell Cut, Limonite.	Black Band, 6 to 12 inches thick under Bell Seam.	Crossbasket, Grayish Black.	Crossbasket, L't-Grayish Black.	Crossbasket, Brownish-Black.	Crossbasket.	Clyde Iron Works.	Clyde Iron Works.	Easter House.	Airdrie Mushet's Black Band.	Magescote.	Fine.	Veschers.	Morillon.	Mouillar, 1st Variety.	Mouillar, 2d Variety.	St. Etienne, 1st Variety.	St. Etienne, 2d Variety.
Specific Gravity,	3.069	2.161				3.201			3.22	3.3801	3.2699	3.1175	3.1793	3.1482	3.2109	3.3109	3.0553								
Carbonic Acid,	29.95		27.2	10.	24.66	18.	17.2	5.7	*40.43	33.63	31.86	30.76	32.53	26.35	33.10	32.24	35.17	‡25.50	‡27.70	‡24.60	‡21.00	‡9.10	‡14.6	‡42.20	‡38.40
Protoxide of Iron,	56.25	18.	54.	25.2	36.	20.09	23.24	8.05		45.84	42.15	38.80	35.22	36.47	47.33	43.73	53.03	25.	37.30	13.	20.30	38.	40.	38.	41.
Peroxide of Iron,					9.99	12.04	12.24	60.46	20.21		0.80	0.33	1.16	0.40	0.33	0.47	0.23								
Protoxide of Manganese,										0.20		0.07		0.17	0.13			0.30	1.70	0.30	0.60	1.40	1.50	2.50	4.10
Lime,	1.	1.	2.	1.5	1.5	4.5	2.	0.5	14.10	1.90	4.93	5.30	8.62	1.97	2.00	2.10	3.33		6.00	7.40	4.20			13.00	0.20
Magnesia,	.72	1.45	1.8	1.64	1.26	1.4	1.4	0.36	.03	5.90	4.80	6.70	5.19	2.70	2.20	2.77	1.77	1.60	1.90	0.80	0.30	2.00	3.00	1.50	0.20
Insoluble Silicates,	6.50	53.	11.5	56.	25.	38.5	38.5	17.	14.87	†7.83	9.73	10.87	9.56	19.20	6.63	9.70	1.40	26.50	25.00	47.10	47.40	44.40	35.70		12.00
Alumina,	2.	5.5	3.5	4.5	1.	4.0	3.5	4.	5.80	2.53	3.77	6.20	5.34	8.03	4.30	5.13	0.63	11.8	0.9	6.3	3.30	4.4	5.5	2.00	3.10
Bituminous Matter,									1.32	1.86	2.33	1.87	2.13	2.10	1.70	1.50	3.03								
Moisture,	0.8			0.6		.80		3.5	3.24	.99															
Sulphur,	0.025				0.06							0.16	.02		0.22	.02									
Loss and Alkalies not estimated,	2.755	21.05		.56	.53	.67	1.92	.43																	1.
	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.68	100.37	101.06	100.37	97.39	97.94	97.66	98.59	100.70	100.50	100.	98.	99.90	100.30	100.20	100.
Metallic Iron,	43.73	14.	42.01	21.72	35.	24.01	27.35	48.65	33.73	35.66	33.34	30.41	28.01	28.64	37.04	34.26	41.41	27.19	29.01	10.11	15.79	29.56	31.12	29.56	31.89

Land Office D. Kingsbury.

* 40.43 Carbonate of Iron.

† 0.80 Phosphoric Acid.

‡ Loss by Calcination mostly Carbonic Acid.

In the valley of Minard Run, on Warrant 3332, a bed of fossiliferous limestone occurs, overlaid by schistose argillaceous sandstone. Two to three feet of this limestone are exposed at Minard Run Lick, where a chalybeate spring issues from the junction of this rock and the superincumbent strata. The chemical composition of this limestone is as follows :

Moisture,	.5
Insoluble silicates,	43.5
Carbonate of Lime,	45.
Peroxide of Iron,	6.4
Alumina,	3.1
Magnesia,	.54
Phosphoric acid,	.6
Magnesia, a trace.	
Loss and alkalies not determined,	.36
	100.

Limestone occupying, apparently, the same geological position, occurs on Warrant 2321, also on the waters of Minard Run, which, judging from external appearance alone, seemed to be more earthy. The analysis proves, however, that it contains less earthy matter and more lime than that on Warrant 3332 :

Moisture,	.5
Insoluble silicates,	27.9
Carbonate of Lime,	67.65
Peroxide of Iron,	2.45
Alumina,	.55
Magnesia,	.73
Phosphoric acid,	.18
Loss and alkalies,	.04
	100.

There are several spaces in the Tunungwant coal fields to which I beg leave to call attention, as more likely to afford limestone, than any other.

Under one of the ore beds below Coal A, in the space between Coals H and I, about 30 to 40 feet above H, and the space between Coals I and K, about 90 to 100 feet above G Coal, the first and last of these spaces have afforded limestone in Sergeant Township, McKean County.

When we view the geographical position of the Tunungwant coal and iron districts, the attention is at once arrested by its favorable position for supplying a vast extent of populous country with these invaluable minerals, of which it is itself destitute, yet consuming already both coal and iron to the extent of many millions of tons annually.

Stretching as its northern limits do within a mile or two of the New York line, while the heart of these mineral lands is only ten to twelve miles from the same line and only seventy-five miles in a direct line from Buffalo, the value and importance of these mineral lands become apparent, especially when we view their position in relation to the network of railroads and canals either already constructed or in prospective.

By twenty miles of railroad, of which the grading is almost completed, the mineral tract will be brought in immediate connection with the New York and Erie Railroad; there would then be a continuous line of railroad to Buffalo by way of Dunkirk, a distance of 113 miles, by which coal can be delivered in Buffalo at a cost of $2.40 per ton, viz :

Mining, 40c., props, 2c., and roads, 3c. in mines,	.45
Opening mines, and contingencies in mines,	.04
Loading into cars, 2c., unloading from cars, 2c.,	.04
Use of cars, repairs, oils, interest, &c.,	.17
Cost of coal delivered in R. R. cars, repairs, &c.,	.70
Freight, 113 miles, at 1½ cents per ton per mile,	1.70
	$2.40

During the season of navigation, it may be carried from Dunkirk to Buffalo by water, which would probably somewhat lessen the cost of transportation. But before long a much shorter route will be open, as the Buffalo and Pittsburg Railroad will be extended to Buffalo direct, and with the Buffalo and Bradford Railroad, form a connection with the Sunbury and Erie and Alleghany Valley Railroads, thus affording a through route from Buffalo to Philadelphia, by the former, and to Pittsburgh by the latter. The distance by railroad will then be lessened twenty-six miles, so that the cost will be reduced to $2.00 per ton.

The Erie Canal and Lake Ontario, with their numerous connections, will, by the same twenty miles of railroad, be rendered accessible at Rochester.

The distance from the mines to the N. Y. & E. R. R. is	19	miles.
From Tunungwant to Olean, ...	12	"
" Olean to Rochester, by Genesee Valley Canal, .	110	"
Distance from mines to Rochester, .	141	miles.

The cost of delivery by this route would be,

Freight, 31 miles by R. R., at 1½c. per ton per mile, . . .	.46½
" 100 " " canal, including tolls and all expenses transhipment,	1.10
	$1.56½
Add for delivery in R. R. cars, &c., ...	.70
Making cost of delivery in Rochester, .	$2.26½

But by the projected extension of water communication from Olean to the mouth of Tunungwant Creek, the expense would be lessened and better facilities afforded for the transhipment of coal.

The distance would then be,

From the mines to Alleghany River, ...	17	miles.
" mouth of Tunungwant Creek to Rochester, . .	121	"
	138	miles.

The cost of transportation by this route would be,

17 miles by R. R., at 1½ cents per ton per mile, ...	.25½
121 " " water, at 1 c., including all expenses of transhipment, tolls, loss, &c.,	1.21
	$1.46½
Add cost of delivery in R. R. cars, &c., ...	.70
Making cost of coal in Rochester, . . .	$2.16½

The coals from your mines could be sold much lower than the cheapest coal offered in this city, and by reference to the analytical table, their quality will compare favorably with any bituminous or cannel coals offered in this market or New York city, as well as in Syracuse, where there is an immense consumption of fuel employed in the manufacture of salt, and upon which fuel no state tolls are charged.

The home consumption of coal for the manufacture of oils, &c., (for which purpose buildings and machinery are now being erected in your village), will form no inconsiderable demand, and must create a large and profitable business, as appears from the following extract taken from the "Miners' Journal:"

"The marvelous qualities of cannel coal for the production of oils, naptha and candle wax or paraffine, are truly astonishing, and would scarcely be credited, were they not fully substantiated by actual experience in Scotland and England, placing the matter beyond dispute. The oil is extracted by a process very similar to that of making gas at our gas establishments, though at a much lower temperature, and the volatile matter leaves the retort as a liquid instead of gas, as in the case where a great degree of heat is used.

"By a process of making, one ton of cannel coal produces about 140 gallons of *crude* oil, which, when distilled, will produce more than forty gallons of *pure* oil, equal to the best sperm oil for burning, lubricating, &c.; twenty-five gallons of naptha or benzole, and fifteen to twenty pounds of candle wax, more beautiful than and far superior to sperm, making the product of a ton of this coal worth from 75 to 100 dollars.

"This oil is equal to the best sperm for lubricating and burning, and it has also been successfully used in painting; and when it is mentioned that for lubricating purposes alone the expenditure for oil by the railway companies of the United States and Canada, amounts to over a million dollars per annum, and that this item is increasing at an enormous rate by railway extensions, besides the immense and growing consumption for all kinds of machinery, it will be readily seen that our estimate of the money value of this extraordinary discovery is by no means overrated.

"The burning oil is very limpid: it resists cold better than the purest sperm, does not gum the wick, and gives a clear and brilliant light.

"The lubricating qualities of coal oil are quite unrivaled, so much so, that in the manufacturing districts of England the use of sperm oil as a lubricator for machinery, has been discontinued, and kerosene or mineral oil is substituted, as being far superior and much cheaper. Mineral oil from the Scotch Boghead Coal or Torbane, was first introduced into the English manufacturing districts in 1852, and was then viewed with suspicion, as being one of a thousand and one impracticable attempts to manufacture a cheap lubricating machinery oil. It was offered at five shillings sterling per gallon."

Dr. Kent, of New York, illustrates the comparative value of light from coal and bituminous shales as follows :

MATERIAL.	Quantity of light from equal measures.	Cost of equal amounts of light.	Retail price per gallon.	Intensity of light.
Kerosene or Oil of Coal,	2.435	$ 4.10	$1.00	13.689
Camphene,	1.293	4.85	.63	5.625
Sylvic Oil,	.826	6.05	.50	1.190
Rapeseed Oil.	1.660	9.00	1.50	5.929
Whale Oil,	.833	12.00	1.00	1.892
Lard Oil,	.706	17.70	1.25	1.640
Sperm Oil,	.850	26.47	2.25	2.025
Burning Fluid	.390	29.00	.87	.553

From these actual results and a reference to the analyses of the different coals, it is evident that for domestic uses, for the generation of steam, manufacture of iron, production of gas, oils—in brief, for every use to which coal can be applied, your lands are adequate to the supply in whatever variety the demands may be made.

When we take into consideration a fact stated to me by a leading citizen of Rochester, that in five years from this time the greater part of the available timber for firewood, will be cut off from all lands lying within fifteen miles in every direction around Rochester, and reflect, at the same time, on the vast consumption of wood by the railroads and in the manufacture of salt near Syracuse, we see at once how universal must be the introduction of coal as a fuel in western New York, before the lapse of many years; and there cannot be a shadow of doubt that coal companies, located in McKean County, Pa., so conveniently situated for supplying these various cities, and who can deliver their coal at Buffalo at the same price that coal is delivered at Cleveland and Erie, have an unfailing market that cannot be overstocked. "For the city of Buffalo," as a cotemporary writer remarks, "lying at the eastern extremity of the upper lake navigation, and at the western extremity of the Erie Canal, becomes the great interport for the vast amount of agricultural products of the West. The increase of these products requires a constant and rapid increase in the means of transportation towards the Atlantic coast. The debarkation of the cargoes of all the steamboats and propellers at Buffalo, renders it desirable that they supply themselves with fuel at this place, rather than turn aside for that purpose to Erie or Cleveland, the two depots of coal on Lake Erie. The upward freight of vessels from Buffalo to the western ports, bears so small a proportion to the downward freight, that vessels are compelled to purchase sand for ballast on their outward trips. It is evident that if coal could be obtained at Buffalo as cheaply as at Erie or Cleveland, these vessels would purchase coal for supplying all the lake ports having commercial intercourse with Buffalo."

The city of Buffalo must be the great point for the distribution of the Tunungwant coal and iron. With a present population of from ninety to one hundred thousand, and rapidly increasing; a large manufacturing interest, steamboats and propellers, amounting to more than 100,000 tons, besides an immense tonnage in sail vessels, railroads and channels of water communication, radiating to every point of the compass, extending to remote parts of the country, Buffalo possesses facilities for the sale and distribution of coal and manufactures unsurpassed by any other city in the country. Already the largest grain market in the world, she only requires cheap and abundant fuel to enable her to become one of the most important manufacturing cities on the continent.

The amount of bituminous coal now consumed in Buffalo, and by the steam vessels running from thence, is reported to be not less than 250,000 tons annually, and this is considered a very low estimate.

The population of Western New York, within a circuit of one hundred miles of Buffalo, is, according to the state census of 1855, about 650,000; add to this the population of Canada West, within easy reach of that city by railroads and water, which cannot be less than 250,000, and we have a population of nearly one million, which very soon will be entirely dependent upon these coal fields for fuel.

On the completion of the Erie Canal enlargement these coals can be transported on it from Buffalo to the city of New York and intermediate points, at a price so low as almost to defy competition. There can, therefore, be no doubt that the demand for these coals will only be limited by the supply.

About 100 feet below the base of the conglomerate and associate sandstones, at the base of the coal measures of McKean county, in the old red formation, there occurs, and can be supplied to an indefinite amount, a pigment of a Spanish brown color, which makes, when washed and mixed with oil, a firm and durable paint.

The soil derived from the old red formation, especially near its junction with the coal measures above, and Ithaca and Portage group below, is remarkably productive, yielding thirty to thirty-five bushels of wheat to the acre, and in favorable years even as high, in some instances, as forty bushels; and that upon abrupt slopes of the hill sides where it might at first be supposed that the soil would be so much washed as to be comparatively barren.

The soil of the table land where it is derived from the calcareous, carbonaceous shales mixed with the *debris* of the adjacent sandstones, is hardly less productive; and, perhaps, better adapted for oats than any of the lands of McKean county.

The lands which form the subject of this report are not only valuable as mineral and agricultural lands, but also for the timber, viz., pine, hemlock, and hard woods, chiefly maple and beech.

It is estimated by those who have made the timber business their trade, that 15,000 acres of these lands will yield of hard wood, fifty cords to the acre, and 10,000, twenty-five to thirty cords to the acre. Forty cords to the acre may be estimated of hard wood, on an average of the whole tract, suitable for making charcoal for blast furnaces. This would be equal to 3000 bushels of charcoal to the acre, equal to the production of ten tons of cast iron to the acre from the whole tract. This is exclusive of the pine; of this kind of timber there are at least 2000 acres on Warrants 4910, 4909, 4908 4907 and 4906, that will cut 20,000 feet to the acre, and about 3000 acres more that will cut 10,000 feet of lumber to the acre.

There are, moreover, vast forests of hemlock, which are destined, in a few years, to be almost as valuable as the pine timber is at the present time.

But on the resources of this country in timber you will have a more special report from Mr. B. Needham, which renders it unnecessary for me in this place, to enlarge farther on this subject.

When we take into account the mineral resources of the Tunungwant coal fields, their agricultural capabilities, together with the immense forests of valuable timber, almost as yet untouched, and their geographical position in connection with the lines of railroad and canals that intersect Western

New York, with which it is just about to be brought in connection by the completion of the Buffalo and Bradford Railroad, it will be difficult to select a country whose future prospects hold out greater hopes of quick and profitable returns to those who may first embark in the coal, iron, and lumber business, or whose commercial prosperity is so certain, if called into activity by the proper class of enterprising and industrious population.

But the advantages which will accrue are not alone to the enterprising individuals or companies who may be instrumental in opening up the resources of this part of Pennsylvania, which has for so long a period been almost overlooked. The lake shore country, the whole of Western New York, and Buffalo in particular, are to derive immense benefits; since it is to furnish that country with a reliable store of cheap fuel of excellent quality, which will be a boon not only individually to every inhabitant of this rich and flourishing country, but must inevitably be the means of introducing and fostering every species of manufactures which its great agricultural resources imperatively demand, and which nothing can now delay but a deficient supply of cheap fuel.

D. D. OWEN,
Geologist.

REMARKS ON THE COAL FIELDS

OF

McKean County, Pa.,

By an experienced Gentleman connected for thirty years with the Coal Region of Schuylkill County, Pa.

Twenty-five years ago the Schuylkill coal region was what the McKean Coal Field is at this time; or rather, it may be said, that McKean has now prospective certainties greater than the people of Schuylkill county dreamed of ten years after that date. By reason of its slow ignition, anthracite found unusual obstacles to its introduction. Steamers complained, as now, that it gave little flame, and burned out the fire boxes and boilers. Iron men said it was not adapted to smelting. Limeburners hooted at it, declaring, "It spoils the lime." But after a time all these found a way to use it, because it was cheap.

At first the Schuylkill Coal Fields had no outlet, but a small canal, with small boats and terrible lockage.* So little did the canal company anticipate the vast trade that was coming, that it gave long leases on the water powers at its locks, which very soon after had to be bought back, at enormous valuations. Scarcely had they secured these, before the immense tonnage made it necessary to enlarge the canal to double its former capacity; and afterwards it was doubled again, with locks greatly enlarged in capacity and reduced in number. Before this last improvement was made, a railroad began to be talked of as necessary. The canal quaked with fear that the railway would take the whole carrying trade. The public said, competition will destroy both. The result proves that both works are taxed to their fullest capacity by a tonnage greater far than all the calculations of both: so much so, that finding there is more coal yearly pressing for carriage, than they can provide means to carry, the two companies (whose canal and railroad run side by side, each often crossing the other) meet in friendly and sensible accord every season, divide the tonnage according to their carrying means, fix a stiff tariff of charges, and indulge in dividends to please themselves.

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* The boats on the Rochester canal carry 100 tons.

We give this bit of history to show that, in this country, even the most sanguine and the most interested, have in all their early estimates of the consumption of coal, fallen short of the actual quantities demanded by the market.

When the Schuylkill coal basins were first opened, and for years after, railroads were unknown in this country. Manufacturing was in its infancy, and houses were not warmed by furnaces. Well-wooded coal lands were bought then at from $30 to $40 per acre. Now they are held for permanent investment at from ten to twenty times that price! And it is very rarely that a coal estate is for sale at all, in that county.

The Coal Fields of McKean are a hundred fold riper than was the Schuylkill coal region, even fifteen years ago. Thirty* miles from the mines of McKean, the New York and Erie Railroad is reached, from which spreads out a vast network of railroads, reaching to the Lakes, and to every part of Western and Central New York, as well as to the city of New York itself. What a population is spread over this vast territory! What markets for coal! What a climate for its consumption!

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* From Tunungwant coal fields the distance is 18 miles.

Manufactories abound here. The long winters stimulate such enterprise to furnish employment and means of wealth. Cheap coal alone is wanted to make this the leading feature of their industry. What dormant iron ores will waken up sources of wealth and healthful labor, through the State of New York, when cheap coal can be had to smelt and forge them! No one doubts now that coal will smelt iron — little else is used. So also with engines in manufactories, in locomotives and in steamboats! Give them coal cheap enough, and they will all consume it. All these are advantages which the Schuylkill coal field had not at its opening, twenty-five years ago; and yet look at its yearly tons now counted by millions, and its boundless success.

Gas was a luxury scarcely known then; but anthracite does not make illuminating gas. Now, every little town that can get bituminous coal, at thrice the cost it will be from McKean, has its gas works. McKean coal would have, in the very first year, a large market from gas works, extending to all the towns and cities between Buffalo and New York, Albany included. This alone would make a very large tonnage.

Besides, the McKean coal field has (what Schuylkill has not) iron ores lying in the shales and in the slates of its coal, than which none can be mined more cheaply; and it has rich limestones to flux the ores. It seems to have the same elements to which Pittsburg owes its mineral and manufacturing wealth; and it awaits only the same enterprise to give it the same relation to the lake country, and to the interior of New York, that Pittsburg bears to the Ohio countries bordering upon her rivers, their tributaries and their confluents.

Situated as McKean is, it has no rivalry to fear from anthracite, nor to any consequential extent with other bituminous coals. There is market at once and thereafter, within its own range, for its whole productive capacity. We may, therefore, without prejudice, speak of the preferences we know to be given to bituminous coals, where the cost is much greater than anthracite.

Our European steamers find it economy to burn bituminous coals at much higher prices than anthracite, and their experience is good for all steamships. The same remark applies to many branches of iron manufacture. In puddling works, for instance, it would be preferred at some advance in price. The tests in locomotive engines, so far as we have them, are favorable to bituminous coals, chiefly coked. Anthracite is now used on railroads in the regions that produce it (where it has supplanted wood almost entirely); but we hear the old complaint, though greatly remedied, viz., that the intense heat necessary for rapid steam-making, burns out the fire box and the tubular boiler-ends. On the Baltimore and Ohio Railway, bituminous coals are used with full success, both raw and coked; and there the running results of every trial with anthracite, are favorable to the former. Wood is at once ruled out by its expensiveness.

We have seen the rise of all our coal regions; but never have we seen one which, at its first opening, had a prospect at all comparable with the McKean coal field, at this time. We were in Schuylkill county when people were just awakening, as now in McKean. Well wooded coal lands were being bought at from thirty dollars an acre, upwards. Men of small means but large foresight, joined together to buy up the properties.

But their wildest dreams of profit were far behind the reality, as well in time as in amount. They made a quick step from poverty to riches. And now what princely revenues they are getting from the rental of their collieries! We speak only what we know. We were with them; and we participate in their fortunes.

Where coal is, there wealth attends. This law is universal. Early in life we made up our minds that coal mines must be a safe reliance. We linked our fortunes with that interest; we have never changed, and it has never deceived us. What the polar star is to the mariner, the coal hills have been to us—a trustful and unerring guide.

And now, if the experience of the past, in every land and in every age, may give safe rules for the future, they who enter the coal field of McKean at this its budding time, will harvest the golden fruit.

What is history in Schuylkill county, is safe prophecy in McKean. But the markets are so much riper in McKean, that, with an entire absence of risk, we may predict for the enterprising pioneers, a much quicker realization.

Enlarged Section of Coalseams
by Prof. B. Needham.

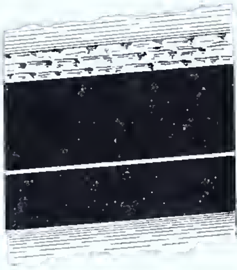
Approximate & Ultimate Analyses
by Dr. D. D. Owen.

L

Black Band on Coal 1F^t 1in.

Slate 1in.

Clean Coal 5F^t

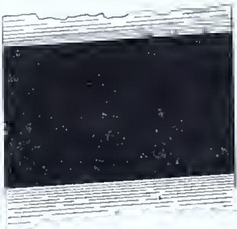


Yields of Metallic Iron 6.30 p. ct. 2.

Moisture	1. 5		Moisture	2. 100
Volatile Matter	39. 5		Carbon	75. 545
Fixed Carbon	55. 0		Hydrogen	7. 222
Ashes (Reddish)	4. 0	100	Oxygen & Nitrogen	5. 133
Tot. Volume	41		Ashes (reddish)	10. —
Coke	59.	100		100. —

G

Clean Bituminous Coal 5F^t



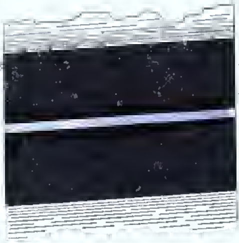
Moisture	1. 5		Moisture	2. 8
Volatile Matter	37. 5		Total Carbon	72. 436
Fixed Carbon	56. 0		Hydrogen	5. 555
Ashes (grey)	5. 0	100	Oxygen & Nitrogen	7. 709
Total Vol.	39.		Sulphur	500
Coke	61.	100	Ashes	11. 000
				100. —

D

Clean Bits Coal 2½F^t

Slaty Cannel 6in

Cannel Coal 2½F^t



Moisture	2		Moisture	1. 6
Volatile Matter	31. 3.		Total Carbon	63. 108
Fixed Carbon	61. 2		Hydrogen	3. 666
Ashes White	5. 5	100	Oxygen & Nitrog.	11. 926
Total Vol.	33. 3		Ashes	19. 7
Coke	66. 7	100		100. —

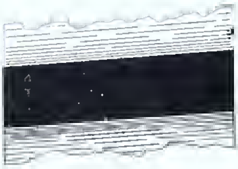
Slaty Cannel

Total Vol.	17. 5	
Coke	82. 5	100

Cannel Coal no specimen.

E

Cannel Coal 2F^t



No specimen. Not analysed.

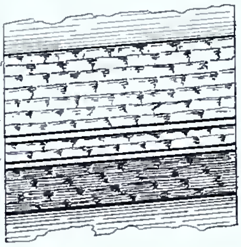
Black Band ore 2' 11"

Olive Shale 1"

Bl. Band

Olive Shale 1"

Bl. Band 1F^t 6"



Yields 5.14 p. cent Metallic Iron.

" 14.00 " " "

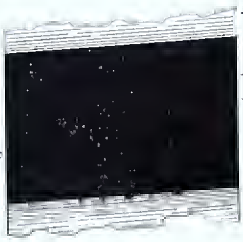
" 43.75 " " "

A

Splint Coal

All clean

varies from 4 to 5F^t



Specifice gravity 1.294.

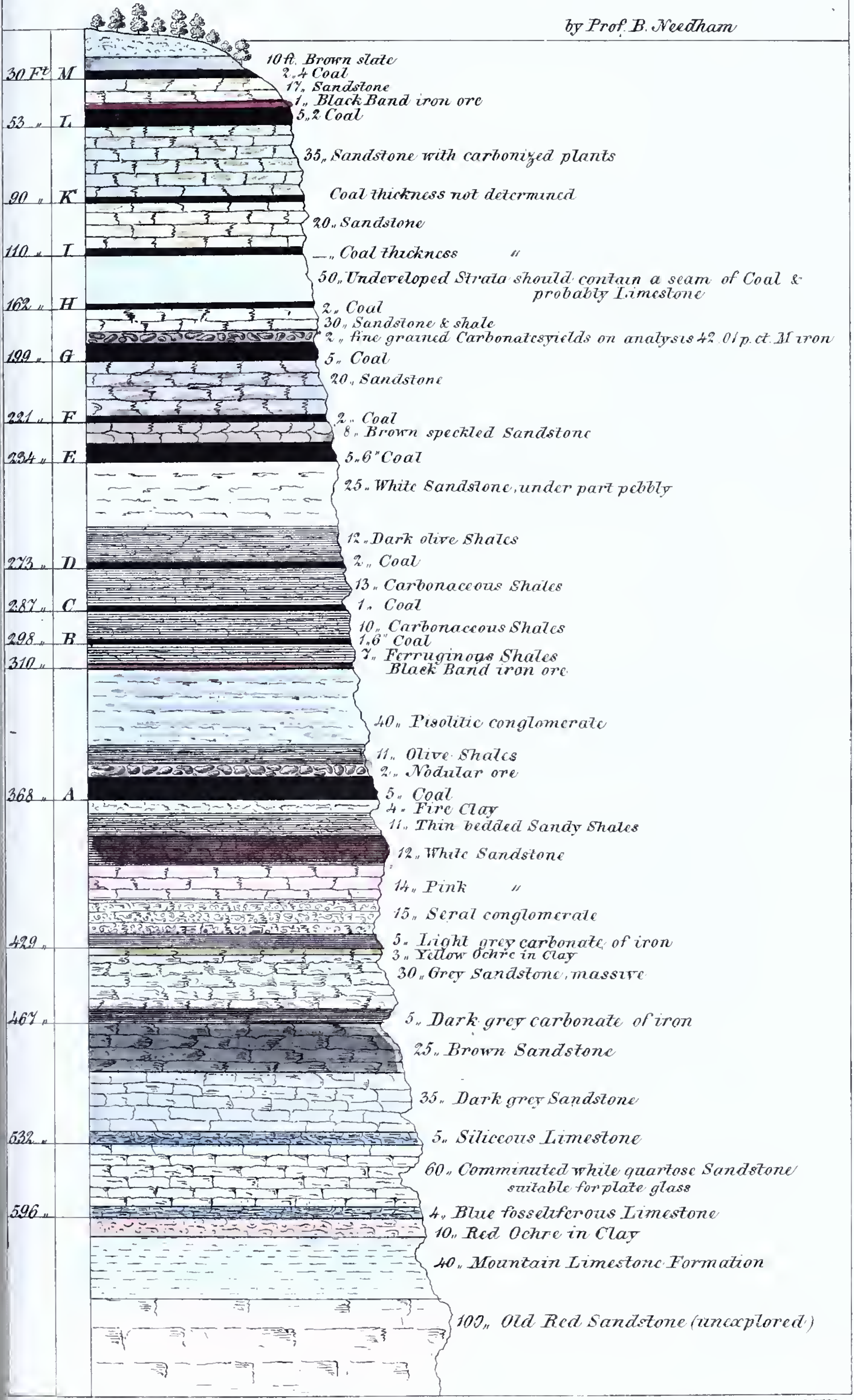
Moisture	2.		Carbon	69. 272
Vol. Matter	32.		Hydrogen	4. 240
Fixed Carbon	59.		Oxygen	15. 488
Ashes (grey)	7.	100	Ashes	7. 400
Tot. Volume	34.		Moisture	2. 600
Coke	66.	100		100.

Drawn by Gustavus Cox M. & C. Engineer.

Lith. by HATCH & Co. 29 William St. N.Y.

Vertical Section

by Prof. B. Needham


30 Ft M — 10 ft. Brown slate
2 „ 4 Coal
17 „ Sandstone
1 „ Black Band iron ore
53 „ L — 5 „ 2 Coal
35 „ Sandstone with carbonized plants
90 „ K — Coal thickness not determined
20 „ Sandstone
110 „ I — — „ Coal thickness „
50 „ Undeveloped Strata should contain a seam of Coal & probably Limestone
162 „ H — 2 „ Coal
30 „ Sandstone & shale
2 „ fine grained Carbonates yields on analysis 42.01 p. ct. M iron
199 „ G — 5 „ Coal
20 „ Sandstone
221 „ F — 2 „ Coal
8 „ Brown speckled Sandstone
234 „ E — 5 „ 6" Coal
25 „ White Sandstone, under part pebbly
12 „ Dark olive Shales
273 „ D — 2 „ Coal
13 „ Carbonaceous Shales
287 „ C — 1 „ Coal
10 „ Carbonaceous Shales
298 „ B — 1 „ 6" Coal
310 „ — 7 „ Ferruginous Shales
Black Band iron ore
40 „ Pisolitic conglomerate
11 „ Olive Shales
2 „ Nodular ore
368 „ A — 5 „ Coal
4 „ Fire Clay
11 „ Thin bedded Sandy Shales
12 „ White Sandstone
14 „ Pink „
15 „ Seral conglomerate
429 „ — 5 „ Light grey carbonate of iron
3 „ Yellow Ochre in Clay
30 „ Grey Sandstone, massive
467 „ — 5 „ Dark grey carbonate of iron
25 „ Brown Sandstone
35 „ Dark grey Sandstone
532 „ — 5 „ Siliceous Limestone
60 „ Comminuted white quartose Sandstone suitable for plate glass
596 „ — 4 „ Blue fosseliferous Limestone
10 „ Red Ochre in Clay
40 „ Mountain Limestone Formation
100 „ Old Red Sandstone (unexplored)

Drawn by Gustavus Cox M. & C. Engineer.

Lith. by HATCH & Co. 79 William St. N.Y.

REPORT

ON THE

Tunungwant Coal Field,

McKEAN COUNTY, PA.

BY PROFESSOR B. NEEDHAM.

To Colonel D. Kingsbury.
Dear Sir:

In pursuance of your request, I proceeded to McKean County, and in company with Dr. Owen, examined several of the tracts of land in the Tunungwant coal field, in which you are interested.

Becoming somewhat familiar with them on a former visit to your county, and from the levels admeasurements and a more thorough exploration recently made, I send you my views in relation to them; with a vertical section of the stratification, an approximate estimate of the quantity of coal and iron ores, with their analyses, a notice of some of the advantages of manufacturing iron, and the facilities of getting to market.

McKean county contains 805,000 acres of land, two-thirds of which occupy a high table land some 600 feet above the Alleghany river. Of these about 125,000 acres are underlaid with coal; of which latter quantity, nearly 75,000 acres lie on the north side of the Kinzua creek, and constitute a separate coal field, to which the name of the principal stream of the region, the "Tunungwant," has been given.

That portion of your lands which I have examined, referred to in this report, comprises 27,545 acres with coal, and 14,083 acres without—making in all 41,628 acres.

These lands extend from near the town of Bradford, on either side of the Tunungwant creek, southerly, to Lafayette corners; thence westwardly to Hamilton township; thence northwardly to within two miles of the State Line; and from thence to near the former town — being nearly all within the townships of Lafayette and Bradford. They occupy the center of the largest coal field in McKean, and embrace twelve seams of coal, five of which are workable.

These lands give rise to, or are intersected by, many small streams, among the principal of which are the Tunungwant, Tunaette and branches, the Sugar Run, Turnip Run, Minard Run, &c., which have cut out most, and in many places, all of the coal measures, leaving the coal and iron ores of very easy access and mine drainage.

These lands are among the best in this coal field, and are favorably situated for mining and transportation; the railroad now being rapidly constructed, passes directly through them for nearly their entire length, offering great facilities for shipping coal, iron and lumber, while they are nearest to market.

From Marshburg, near the center of these lands, to the New York and Erie Railroad, is nineteen miles; while the distance from the center of the other basins east of Lafayette, is about forty-eight miles, as yet without any outlet.

As regards the lands south of the Kinzua creek, they are unquestionably as good as those on the north; but the Kinzua has cut down a deep gorge through the coal measures, which is impassable for railroads, without running round its head waters an average distance of at least eight miles. This extra distance will make a great difference in the value of coal lands. For instance, the freight and toll for eight miles of railroad, at 1½ cents per ton per mile, would be 12 cents; and as your coal lands average about 6000 tons per acre, it would cost to move the coal from one acre, of as good quality as yours, seven hundred and twenty dollars, to Lafayette, the most remote of your lands from market.

Now after deducting the interest on all lands not worked, it will be perceived that lands on the north of the Kinzua are worth much more than those on the south side, say 200 dollars per acre.

Practically we find these figures have, for every mile in our anthracite coal fields, a great influence, and one which cannot be remedied.

The course of these basins is south 40° west and north 40° east, with a south-western dip of the synclinal axis of 12½ ft. per thousand, or about one degree.

The eastern and western dips are very gentle, varying from three to eight degrees, and forming quite flat basins.

As we approach the north-eastern terminus of this coal field, the measures are gradually lifted out, so that only one seam, very much thinned out, passes over the New York State Line, and this is the only basin whose coal measures approach within ten miles of that line.

The mineral resources of these lands consist of bituminous and cannel coals; carbonate and black band iron ores, in great abundance; limestone; fireclays and mineral paints—(the red and yellow ochres)—and a comminuted quartzose white sandstone, suitable for the manufacture of the best flint and plate glass.

The surface is gently undulating and very well adapted to tillage, and most of it yet covered with a fine growth of timber, embracing white pine, hemlock, and most kinds of hard wood.

We were much assisted in obtaining the measurements of the stratification, from which our section is made up, by the numerous shafts, drillings, sidecuts, openings and other developments made under the supervision of Mr. Casey, assisted by Mr. Haffey, on these lands, and from which the measures have been more accurately and nearly all determined.

I have divided these lands into the large tracts by which they are generally known, without specifying each warrant, as being more comprehensive.

I. Of the Coal.

The Marshburg Tract (embracing 3648 acres, purchased from the Fox & Ross Estate) contains 8000 acres, and is covered by eight warrants.

I have set the analyses opposite each respective seam of coal in the enlarged section, so it can all be seen at one view.

There are four workable seams of coal on these lands: the first of which, marked "G" on the section, is five feet thick, where opened quite pure, and without much slate. This will produce, according to the usual method of computing quantities, 5000 tons per acre; but the practical results of close scientific mining, would give 5,150 tons.

This seam underlies 950 acres of this tract, and will yield at least 4,750,000 tons of good merchantable coal.

It is proper to remark, so far as regards the analyses, that the specimens taken for trial were obtained from the outcrops, where they have long been subject to deterioration and evaporation of their more volatile ingredients, and will not show as fine results as if taken from under a good mine roof.

The second workable seam on this tract is marked "E," on the section. This seam varies in thickness from 5 to 5½ feet, and is about half bituminous and half cannel, with 6 inches of slatey cannel. The bituminous and cannel interchangably vary from 20 inches to 3½ feet in thickness, and the average thickness of each is about 2½ feet, the whole producing 5000 tons per acre. As Dr. Owen mislaid the specimens of the cannel part of this seam and had none to analyse, I give the one I have.

Moisture,	.62		
Volatile matter,	41.77	Total vol. combustible matter,	42.39
Fixed carbon,	46.45		
Ashes,	11.16	Coke,	57.61
	100.		100.

This specimen had been exposed outside an old drift, for many years, and much of the volatile matter had escaped, and, therefore, only approximates to its real qualities.

This seam underlies 1350 acres of this tract, and will yield 6,750,000 tons of coal, one half of which is cannel.

The next seam in the series is a cannel coal, and marked "D." It is two feet thick, with a floor and roof of carbonaceous shale, either of which is easily removed. We seldom estimate any vein of coal less than three feet thick, but from the very valuable product of this seam I think it will do to work.

The seam of coal known as the "Bog-head" of Scotland, and which has made, and is making, such a great change in the price of oil in England, is only ten inches in thickness. and with all its expense of mining is extremely profitable.

The Breckenridge coal seam, only twenty-eight inches average thickness, with a hard sandstone roof, and an indurated clay floor, costs a little over one dollar per ton to mine it; but is worked to a great profit; and I do not see why the "D" vein cannot be worked to advantage whenever the one above it shall have become exhausted. It underlies 6400 acres of this tract, will produce 2000 tons per acre — and yield 12,800,000 tons.

The lowest and best working seam in the measures of McKean County, is known as the "Splint," and marked "A." It is a fine bituminous coal, of lamillar structure, color black, and fracture rectangular. It is one of the varieties known in England as as the parrot, or cannel; and is well adapted to the the manufacture of iron, in its raw state; excellent for domestic use, and will work well in a locomotive without coking. It burns freely, has no appreciable amount of sulphur, little water, and leaves few ashes. It varies in thickness from four to five feet, in the different localities where it is opened, and will average on this tract 4½ feet — producing 4500 tons per acre; and as it underlies 7,100 acres, will yield 31,950,000 tons: making a total on this tract of 40,075,000 tons of bituminous, and 16,175,000 tons of cannel coal.

The next tract, covered by parts of six warrants, embracing 1383 acres, and known as the "Farm Lands," is situated at and around Lafayette corners.

It contains five workable seams of coal of 21½ feet in thickness, besides slates, and six inches of slatey cannel.

The first working vein on this tract is marked "L" on the section, and is five feet two inches thick, with a thin slate, about an inch thick, leaving five feet of clear merchantable coal, of very good quality. This seam underlies 175 acres of this tract, produces 5000 tons per acre, and will yield 875,000 tons.

Next come some undeveloped strata, containing two seams of coal, as indicated by their outcrop, one of which is dug into a well at the village, and should be from 3 to 3½ feet thick, above which may be a limestone three to four feet thick; corresponding with one further south-east; but as they are not yet opened, and as the season closed on us so as to prevent us from farther extending our explorations satisfactorily, I have made no account of it.

The second workable vein on this tract is the "G" seam, which has heretofore been described, and which underlies 1030 acres — producing 5000 tons per acre, and yielding 5,150,000 tons.

The third seam in the series is the "E" vein before described, which underlies 1045 acres, works full five feet of cannel and bituminous coals, produces 5000 tons per acre, and will yield 5,225,000 tons.

The fourth workable seam is the "D" vein, which underlies 1164 acres of these lands, producing 2000 tons per acre, and yielding 2,328,000 tons.

The fifth and last seam is the Splint "A," which will average 4½ feet on this tract — producing 4500 tons per acre, and as it underlies the whole tract, will produce 6,223,500 tons, making 14,861,500 tons of bituminous and 4,940,000 tons of cannel coal.

North-easterly from Lafayette corners, and on the east side of the main branch of the Tunungwant, are the lands known as the "Minard Run" tract, covered by parts of nine warrants, and embracing 8547 acres.

This tract contains three workable seams of coal, the first of which is the E vein, to which a shaft has been sunk in, or near the outcrop.

This seam underlies 2345 acres of this tract, works 5000 tons per acre, and will yield 11,725,000 tons.

The second seam is the D, underlying 3500 acres — producing 2000 tons per acre, and yielding 7,000,000 tons.

The third and last seam is the Splint A. This underlies 4980 acres, and will average only four feet — producing 4000 tons per acre, yielding 19,920,000 tons — making 25,783,000 tons bituminous and 12,862,000 tons of cannel coals.

On the west side of the main stream of the Tunungwant, and extending from near Bradford village to within a short distance of and adjoining the Marshburg tract, is the large piece of land covered by thirty warrants, and embracing 23,698 acres, of which 14,082 are underlaid with coal.

There are but three workable seams on any of these lands. The "E" vein is the first on this tract, and underlies only 675 acres of the southern portion, the balance having been lifted out, with the measures above, as you go north, and washed away. This will produce 5000 tons per acre, and yield 3,375,000 tons.

The second seam is the "D" vein, which underlies 2580 acres—producing 2000 tons per acre, yielding 5,160,000 tons.

The splint seam A, the last in the measures, is thinned out to four feet on these lands. It extends over these lands and the State line, before it is all lifted out, and underlies 14,082 acres; the rest having been denuded and washed away, and cut out by the Tunaette creek and its branches. It will produce 4000 tons per acre, and yield on the whole 56,328,000 tons: making 58,016,000 tons of bituminous and 6,847,000 tons of cannel coals.

These estimates are made up from the warrants in detail, after deducting all the mine waste, pillars, and slates; and I have been over them several times correcting errors first made, and I think you may with much confidence rely on the result.

RECAPITULATION.

The Tract of Acres.	A	D	E	G	L	Tons of Bituminous.	Tons of Cannel.
8,000	7,100	6,400	1,350	950		40,075,000	16,175,000
1,383	6,223	1,164	1,045	1,030	175	19,701,500	4,940,000
8,547	4,980	3,500	2,345			25,783,000	12,862,000
23,698	14,082	2,580	675			58,016,000	6,847,000
41,628	32,385	13,644	5,415	1,980	175	143,575,500	40,824,000

II. Of the Iron Ores.

All over this section of country a great superabundance of iron ores exists. There are two veins of silico-argillaceous carbonates, covering a much larger area of these lands than the seam of splint coal. There are also two deposites of nodular iron ore, and a belt of black band ore of very superior and unequaled quality.

This black band covers an area about equal to the "D" vein, and from its being found sixteen miles distant of similar quality, would appear to be persistent over quite an extent of country.

It is found on these lands five feet thick, eighteen inches of which is richer than any known in Europe, their best yielding only 36 per cent. metallic iron, and fourteen inches thick; while this proves, from several analyses, to contain 43¾ per cent.

The nodular ores over the A and G veins, as seen in the section, are of very good quality, containing, as per analysis, 42 per cent. metallic iron, and equivalent to a band of solid carbonate at least eighteen inches thick.

The two large veins of carbonates will work full 8 feet of clear ore, and, from the analyses of several specimens, yield from 31 to 39 per cent. metallic iron.

This gives eleven feet of workable ores, and as each cubic yard of ore yields iron enough for one ton of pig metal, the result would be 16,000 tons of metal per acre, after making liberal deductions for mine waste, supports, &c.

The Marshburg tract would yield in round numbers,	64,000,000	tons.
" Lafayette " " " " "	22,000,000	"
" Miuard Run " " " "	54,000,000	"
" Large tract, " " " "	224,000,000	"

making ore enough for, say 364,000,000 tons of pig metal, a quantity three times greater than all the coal and timber on the lands could manufacture.

As there are large quantities of hard wood timber on these lands, I think the most profitable purpose to which they could be applied, would be the manufacture of cold blast charcoal iron,—a kind in great demand, especially by the government, and which always commands the highest prices.

These lands all contain wood enough to make ten tons of iron per acre, including the hemlock timber, except the Lafayette farm lands and a part of the Marshburg tract. There is still wood enough on the latter lot to make

	70,000	tons of charcoal iron.
On the Minard Run tract,	85,000	" " "
On the large tract for	237,000	" " "

Making fuel enough for the production of 392,000 tons of charcoal iron, worth 36 dollars per ton at the furnace. With the black band ore to mix with the others, a very superior quality could be obtained.

Persons unacquainted with the working of black band ores, would be very much surprised at the results obtained by mixing them with others. They increase the production of the furnace one-third, some say one-half, per week.

The presence of carbon, whether in chemical or mechanical combination, increases the fusibility of all ores, and when they contain even small portions of carbon and considerable silica, are smelted with greater facility and produce superior iron to those entirely devoid of it.

"If the quantity of carbon is large," says Truron, "as in the carbonaceous ores, the consumption of fuel is reduced nearly one-half, and the fusibility of the metal so great, that with the reduced consumption of fuel, the production is increased to nearly double the quantity which it is possible to obtain of as good quality, from the same furnace working on other kind of ores." See Truron on Iron Manufactures of Great Britain.

From the cheapness of mining the ores, and other facilities on these lands, I think iron can be made for thirteen dollars per ton, and cold blast charcoal for fifteen dollars.

In reviewing the whole subject of the manufacture of iron in McKean County, its facilities to market, the cheapness of all the materials to produce it, &c., I cannot perceive why Lafayette and Bradford townships would not be very desirable locations for the erection of large furnaces, rolling mills, and other iron manufactories.

III. Of Limestones, Fireclays, &c.

On these lands, lying below the coal measures, is found a limestone (the analyses of which is given) in sufficient quantity for all the purposes of agriculture and manufactures, and of reasonably good quality. The same may be said of the fireclays under the splint seam, and some smaller bands under the smaller seams of coal.

Below the limestone, occur two veins of a very good mineral paint, a red and yellow ochre; and there are several places where it can be very easily obtained.

IV. Of the White Pine Timber.

On the large tract of 23,698 acres, there are 3000 acres covered by six warrants, which produce a very superior quality of pine timber, as well as some cherry; these are the most valuable of all the different kinds of timber growing on these lands. There are large quantities of hemlock, and of most excellent quality, being of the white kind; but it is questionable whether it will bear transportation to market with as much profit as to work it up for making iron. There must be over 300,000,000 feet of hemlock; but I have not examined it with a view to manufacturing.

On the 3000 acres bearing white pine, and some cherry, I have estimated the quantity of lumber which it would saw out, at 75,090,000 feet, board measure. There is also one warrant on Minard's Run tract, containing white pine enough for 5,000,000 feet more.

This timber is of the best quality of any with which I am acquainted in the State, being of the kind known as the "soft spongy pine," and which is worth three dollars per thousand feet more, among joiners, than the "hard white;" full ten per cent. of this timber will make clear, or panel stuff. The facilities for getting it to market ore favorable, and five dollars per thousand can be realized as net profit. Good pine timber is getting scarce, and it will pay good interest on its cost to let it stand for a few years.

V. Of these Lands for Farming.

All these lands are situated on the high plateau of McKean County, and but few of them are cut up so much by the streams as to render them unfit for tillage.

They generally undulate enough for drainage, while they are sufficiently level for easy and convenient culture. The soil of most of these lands, produced by the decomposition of the shales of the coal measures, is generally good and strong, and when cultivated produce good crops. They all bear evidence of being good grass lands, and are said to be more durable than the lower lands along the streams.

These lands would make good farms, and those who cultivate them would always find a good and steady home market for all their produce.

VI. Of Cost of Production.

From a central point on these lands, the distance to Buffalo would be about 86 miles, and coal can be laid down there for $2.31 per ton.

Cost of mining, 40c.; prop timber, 2c.; roads in mines, 3c., .	.45
Cleaning and loading into cars, 6c.; opening mines, 1c., . .	.07
Contingencies in and about mines, ...	.03
Freight and tolls on 86 miles at $1\frac{1}{2}$ c. per ton per mile, . .	1.29
Use of cars, oil, repairs and interest on do, ...	.27
Wharfage and unloading, 4c.; 3 per ct. loss in wt. on $2.11, 6c.,	.10
Contingencies of freight and shipping, ...	.10
	$2.31

For the above figures, I feel confident that coal can be delivered in Buffalo; for anything less, some change must take place in freight, or the railroad company must find and keep in repair the coal cars, before it can be done.

SUMMARY OF THE RESOURCES OF THESE LANDS.

27,545 acres coal lands producing	143,575,500	tons	bituminous coal,
and	40,824,000	"	cannel "
Ores for the production of .	364,000,000	"	pig metal.
Wood for making . . .	392,000	"	charcoal iron.
White pine for producing .	80,500,000	feet of	lumber.
Good farming lands, say . .	40,000		acres.

And limestones, fireclays and mineral paints.

VII. Of the Markets.

With the great mineral resources and the development of these lands, a market for the sale of their produce is of some importance, and a few remarks from me may not, in this connection, be out of place.

In the *locality* of these lands and their proximity to market, you are remarkably favored, as all the lands north of the gorge of the Kinzua are so much nearer market as to place them beyond the reach of successful competition from any other source.

McKean County must, from her position to the markets, and the superior excellence of her coals for gas, supply all northern and eastern New York, as well as the Canadas, for that purpose. On comparison of your coals with the average of all the English gas coals which show 3438 per cent. of volatile matter, and of forty-nine specimens of her cannel coals, 47 per cent., you will perceive from the analyses that your coals are superior to average qualities.

To make a good gas, satisfactory to the people of New York, I find they require a mixture of nearly one-half cannel with their bituminous coals; and your lands can furnish both kinds in quantities limited only by the demand. The erection of oil works on this property would be, perhaps, the most profitable disposition which could be made of the cannel coals, though much would depend upon their cost delivered in New York city. While cannel coals are worth fifteen dollars per ton for gas and domestic use (for which purpose a good deal is consumed) in New York city, the cost of delivery cannot much exceed $6.50. This would leave a large profit on them; but, perhaps, not so much as could be realized by making them into oils, the expense of which, would be about 16 cents per gallon,—the cost given by the Western Mining and Manufacturing Company, whose cannels yield 40 gallons of refined oil, 30 gallons of benzole, and 20 to 25 lbs. of paraffine per ton. From the specimens which I have seen and tried, of their coal, I find yours the richest, and I think you can reasonably rely on its being very profitable.

I think the greater portion of the upper seams of your coals will be disposed of for gas purposes, while the splint, or lower seam, will be used in the manufacture of iron, domestic fuel, and for running locomotives, to which use large quantities must soon be applied.

Prof. Hall, state geologist, of New York, in his report on the McKean County coal field, says: "The geographical situation of this coal field, in the first place, gives it the advantage of some 100 miles of transportation over every other basin of any considerable extent. It has also the greater advantage in its short line of railroad to Buffalo, the most important point to be reached by the coal interest."

"Perhaps there is no city in America more favorably situated than Buffalo for vending the products of industry: with a surrounding country of unrivaled fertility; with the natural advantages of extensive lake navigation and the termination of the Erie canal,—there are no less than seven railroads which already, or soon will have, their termini at Buffalo.

"Pittsburg has been cited as an example of manufacturing industry. In 1825, Pittsburg consumed 35,714 tons of coal; in 1845 her consumption reached 464,286 tons, and now exceeds a million." What hinders Buffalo, with a larger population and more advantageous location, vieing with Pittsburg in her manufacturing industry, but the want of a cheap fuel?

In four years from the time the first train of coal cars reaches Buffalo, laden with the minerals of McKean County, the demands of the trade will require a million of tons per annum. From that time the inhabitants of that city may date their increased and permanent prosperity.

From thirty-one years residence in the anthracite coal fields of Pennsylvania, when in 1820 the markets were fully supplied with 365 tons, I have, from experience, acquired some knowledge of its past history and expansion, and I can with a little pretension to knowledge, judge of the prospects of its future developments.

Creeping along from 1820 with feeble force and infantile energy, we succeeded, in 1842, in bringing the shipments up to 1,108,418 tons. From 1840 may be dated the time when the coal business assumed system, health, permanence:

In 1845 the increase was nearly a million, viz.,	2,013,013	tons.
1848 brought it up to	3,089,238	"
1851 " "	4,329,530	"
1854 " "	5,831,834	"
At the end of 1855 it was over . . .	7,000,000	"

This shows the steady rate of expansion of the trade to be a little over a million in three years, and yet the trade is still in its infancy, comparatively; for all the coal mined and sent to the eastern markets on the Atlantic seaboard, including all the importations from foreign sources, from 1820 to 1855 both inclusive, a period of thirty-six years, amounted to only 61,156,965 tons. For the year 1855 England consumed and otherwise disposed of 64,453,000 tons; ten years before her consumption was only 30 millions of tons. Whence this great increase of the mining product of England in so short a time? It can only be accounted for by the great increase of her steam marine, and the usual increase of her manufactures.

The whole mine product of coal for the world, was only 95,000,000 of tons for 1855. Being the second coal producing nation, our portion of that, including our western coal fields, was 12,335,000 tons.

The commercial tonnage of the lakes, of which Buffalo may be said to be the center, is of itself of large dimensions, and it is computed that her daily consumption is about 1000 tons of coal. Nearly an equal amount would be consumed in her foundries, smithies, manufactories, gas works, and for domestic uses, if a supply could be furnished at reasonable rates. With a population of 90 to 100,000 inhabitants, the consumption of Buffalo may be set down at about half a million of tons per annum.

The cities and towns of Canada can be furnished direct from the port of Buffalo, in the cheapest and readiest way, with a full supply.

Much of these gas coals will find their way to Chicago, and other north-western cities, as the quality is so much superior to their own for that purpose. A few years ago, out of the Atlantic cities, gas was not used at all—scarcely known; now its use is limited to those towns which can get their coal to make it at more than double the price for which the gas coals of the Tunungwant field can be delivered. In two years from the opening of your railroad, all the towns and cities between the mines and New York, will be erecting their gas works, and using these coals. These towns and cities, with the adjacent lake towns of Canada, containing over a million of inhabitants, can be reached either by railroad or canal, and their varied wants supplied by the coals from this field.

The Tunungwant coals can be sent to New York city, via the Genesee and other canals of the state, at a handsome profit—for the gas coals are very irregularly supplied to New York and other eastern cities, and at high prices; there is no source where they can get their supplies so cheap and of as good quality, as from this quarter. New York draws the greater part of her gas coals from Pittsburg and Richmond, depending on the foreign supply for the balance, which is sometimes precarious, having in the winter of 1855, at one time, only six days supply, with the price up to $22 per ton.

In reviewing the whole railroad system of the United States, where there are over 5000 locomotives running, a demand is springing up, inevitable, unavoidable, and of the most imperious character, to supply this great system with cheap fuel; necessity is already forcing this subject on the consideration of all the various companies. A few details will suffice: north and west of the Chesapeake some few more than 3000 locomotives are running, requiring, at the usual rate of 800 cords per annum, 2,400,000 cords of wood;

this is equivalent to 60,000 acres of wood land annually stripped off.

The salt works of Syracuse, alone, sweep 11,000 acres of its forests from its surface; five-eighths of the cost of which might be saved by the use of coal,—and bituminous coals work admirably in making salt.

To supply the farming interests and domestic wants of an agricultural population like New York, would denude from 10 to 20,000 acres more of its wood, and, with the Eastern states, make up 100,000 acres of wood land annually swept off. How many years can this state of things continue, even with wood at double the price of coal? Many of the roads are using coals with success. The Baltimore and Ohio use it both raw and coked. The New Creek Coal company, speak of it in their report, as follows: "It is shown by the results that bituminous coal is 50 per cent. cheaper than wood, where the latter costs little more than the chopping of it." The Reading Road uses anthracite, with a saving of 5 cents per ton on their whole amount of freight. The experiments tried on the Illinois Central, in running a distance of 2310 miles with wood and coal, are as $115.50 for coal, and $389.32 with wood.

From the above considerations, and others that could be added, I am satisfied that our railroad system cannot be further permanently extended; nor much longer continued without resorting to the use of coal. From the use of coal on our railroads as a fuel, may be dated a great increase in their usefulness: to themselves, by indirectly creating an additional business; to the public, by the employment of additional labor, the great increase of mine products and manufactures, and a fair reduction in the general price of fuel to the consumer.

Leaving further statistical details to the business man, and those more directly interested in this subject, I am satisfied that those who acquaint themselves with the vast commerce of the lakes, and the manufacturing interests of Buffalo and adjacent cities and towns, must be favorably impressed with the importance, the permanence, and extent of the coal trade, so necessary to the wants and prosperity of so large a population.

Reviewing the great resources of your lands, the economy with which they can be worked, their proximity to a large market, and the excellent quality of coal with which to supply that market, one must become impressed with a belief in their great and increasing value.

I have thus, Sir, given you my views of your lands as suitable for great collieries, large furnaces, rolling mills, lumber establishments and farms, and hope the same may prove satisfactory.

I am, Sir,
Very respectfully yours, &c.,

B. NEEDHAM,
Mining Eng. and Geologist.

SCRANTON, March 31st, 1857.

E. R. JEWETT & Co.'s Steam Press, Buffalo.

EXTRACT

FROM

Dr. D. D. Owens' Geological Report

ON THE STATE OF KENTUCKY.

Between thirty and forty years ago, when the iron trade in Scotland received a fresh impetus by the introduction into the business of various improvements, and a new raw material, hitherto overlooked or considered impracticable, a family of the name of Baird owned a small farm of some thirty or forty acres between seven or eight miles from Glasgow.

This property was underlaid by a bed of coal—the Monkland coal seam—which was worked to a very limited extent by the proprietors, and hauled by *single cartloads* to the Glasgow market.

Partly from this small coal business, and partly from the products of the farm, the family barely made a living; finding it often difficult to make the two ends meet. So limited, indeed, was their means, that the father considered the business inadequate to the support of the family, so that as the two eldest sons grew to manhood, he urged upon them the necessity of seeking a livelihood elsewhere, in some other business.

During the excavations for the coal on the farm, a kind of ironstone had been encountered, and considerable quantities taken out, which lay scattered in piles at the mouth of the pit, as worthless rubbish, encumbering the ground.

At one of these family meetings, while counciling in regard to future prospects, it was suggested by the eldest son that perhaps they might be able to make iron profitably from some of these waste ironstones. The father, supposing the amount of capital required to commence such a business entirely beyond their limited means, thought, at first, such an enterprise out of the question. Finally, however, by uniting the whole savings of the family, and effecting certain small loans, the father and sons managed to erect, with the sum of £1200, an iron furnace for the production of pig iron from their black-band ironstone and coal.

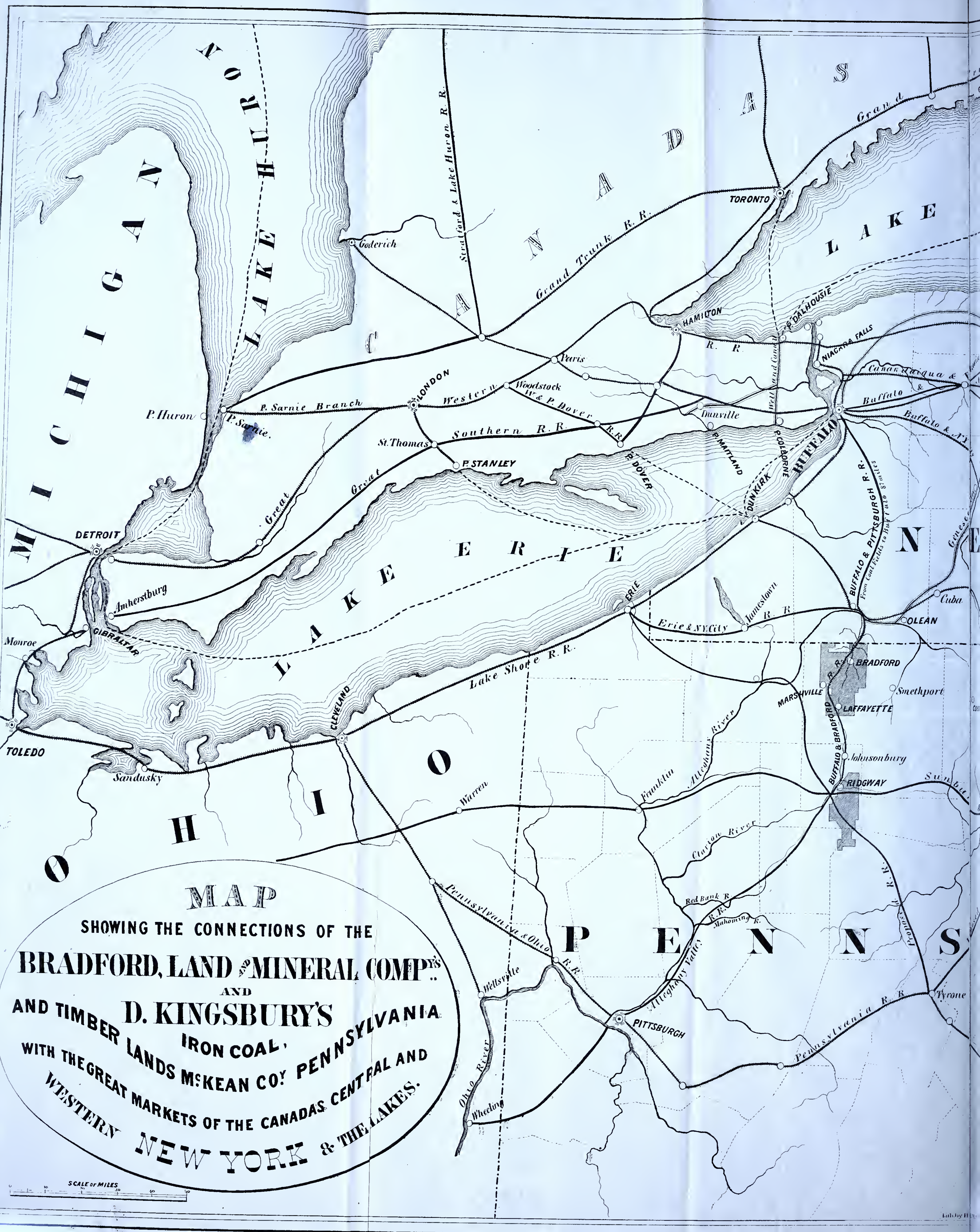
The business succeeded beyond their expectations; in a few years they were not only able to pay off the borrowed capital, but had laid up a surplus sufficient to erect another furnace. Soon they were able to purchase adjoining coal and iron property, and lease the mining right for black-band ore on other estates. This being about the time of the first successful introduction of that species of ore for making iron, its real intrinsic value was, as yet, but little known; so that they were enabled to obtain mining rights for this ore at a shilling a ton, while some of their neighbors in the same business, starting later in this branch of the trade, paid 15, 16, and even as high, in some instances, as 18 shillings per ton for their mining right or lordship.

Progressing in the business under such favorable auspices, wealth flowed in fast, and they were enabled to extend their business rapidly, and put into operation furnace after furnace in rapid succession, and add, from time to time, considerably to their mineral lands. Ultimately, on their well known estate of Gartsherry, celebrated throughout Scotland, there were sixteen furnaces in blast, besides three or four more in Ayrshire.

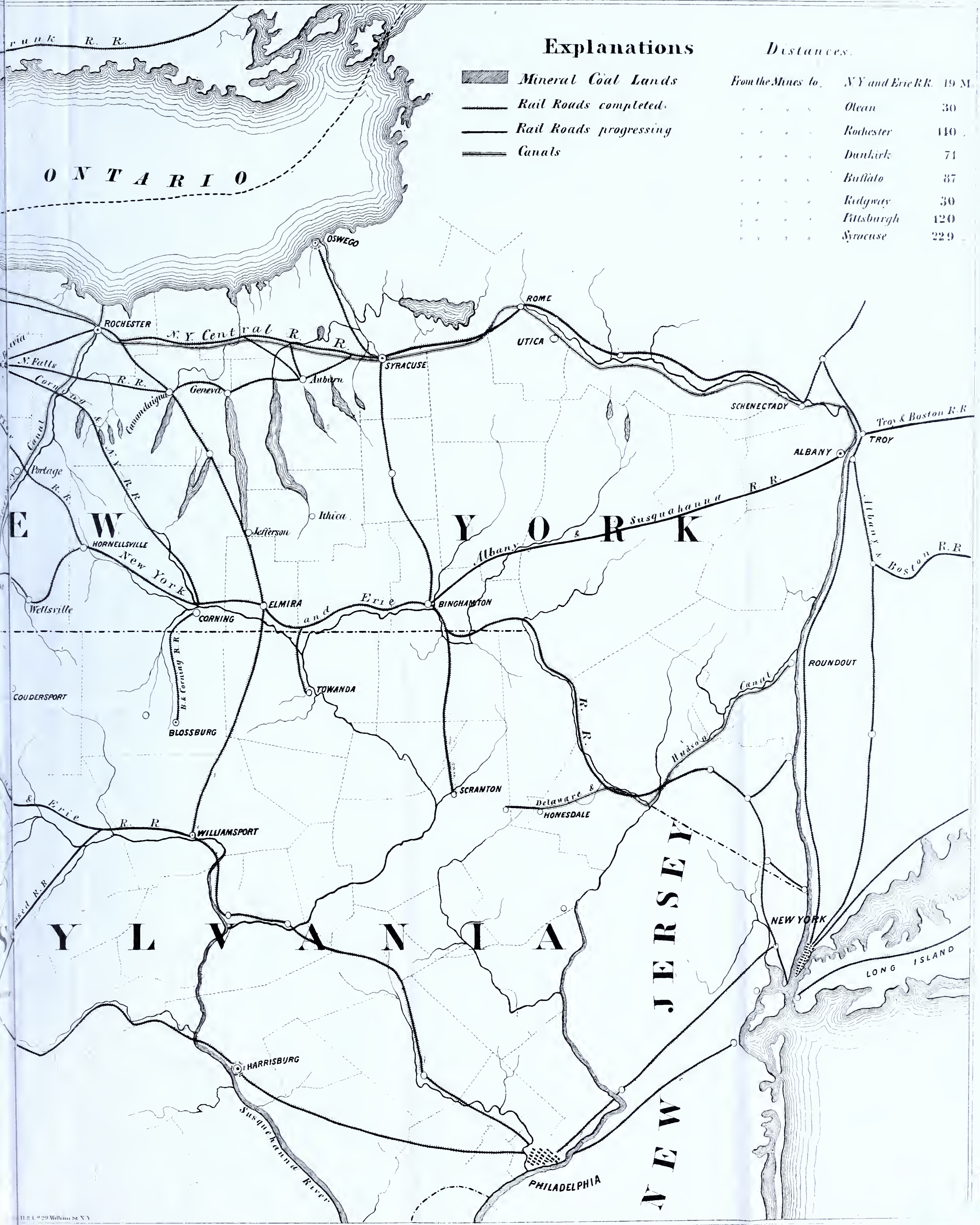
That Baird family are now in the annual receipt, from their coal and iron works, of a clear profit of half a million of pounds sterling, or two and a half million of dollars; wielding a monied influence beyond even the princes of the land.

Let it be forcibly impressed on the minds of my readers that this immense wealth was not amassed by speculation, but by legitimate earnings from a business producing an article of the greatest intrinsic value—a metal to which Great Britain owes, perhaps, more than to any of her other numerous manufactured products, her national greatness—and giving, at the same time, constant employment to whole towns of industrious inhabitants; the material from which all this wealth was extracted, a mineral taken from the bowels of the earth, regarded for centuries as worthless.

Thus it is that Great Britain has risen to the apex of commercial prosperity; thus it is that the United States, at this very moment, is paying her "a golden tribute" of $30,000,000 annually for imported iron alone; thus it is that her iron manufacturers can raise their millions with as much ease as we our thousands.



MAP
SHOWING THE CONNECTIONS OF THE
BRADFORD, LAND AND MINERAL COMP'Y'S
AND
D. KINGSBURY'S
IRON COAL,
AND TIMBER LANDS McKEAN CO.Y PENNSYLVANIA
WITH THE GREAT MARKETS OF THE CANADAS CENTRAL AND
WESTERN NEW YORK & THE LAKES.



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